

# NUMERICAL METHODS FOR INCOMPRESSIBLE NEWTONIAN FLUID FLOW

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For incompressible Newtonian fluid flow with homogeneous density, the primitive physical equations are the conservation of momentum and the constitutive law. This is a first-order partial differential system for the physical stress, velocity, and pressure. By differentiating and eliminating the stress, one obtains the well-known second-order incompressible Navier-Stokes equations in the velocity-pressure formulation. Although substantial progress in numerical methods and in computations has been achieved, the Navier-Stokes equations may still be difficult and expensive to solve. In this talk, we first derive the (pseudo-) stress velocity formulation for incompressible Newtonian fluid flow. We then develop accurate, robust, and efficient computational methods based on this formulation for both stationary and time-dependent problems.